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A CONTRIBUTION TO THE KNOWLEDGE OF THE GENUS BRANCHIPUS.

BY O. P. and W. P. HAY.

1. *The Hatching of the Eggs of* B. VERNALIS *Kept in Dried Mud. Branchipus vernalis* is, according to our present knowledge, distributed from Eastern Massachusetts to Western Indiana. It lives in ponds which are filled with water during the colder parts of the year, but which are dry during the summer months. The eggs, therefore, which when laid by the females sink down into the mud, remain during the hot months enclosed in the dry and baked earth and resume their activity and complete their development only when the cold autumn and winter rains come on.

The species of Branchipus whose life-history has been most thoroughly studied is *B. stagnalis* of Europe. As long ago as 1820, Benedict Prevost experimented with its eggs. Some of these were kept in dried mud for six months and at the end of that time on being put in water developed into swimming larvæ. Some of the eggs, similarly dried, were sent to M. Jurine at Geneva, and this naturalist also succeeded in obtaining the young.[1]

Naturalists have hitherto not been so successful in hatching out the eggs of our species. In Dr. A. S. Packard's "Monograph of

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Claus, *Branchipus stagnalis*, etc. Göttingen, 1873, p. 1.

the Phyllopod Crustacea of North America,"[2] Dr. Paul F. Gissler gives the results of his efforts to obtain the larvæ from dried mud:

"During the whole summer of 1880 I experimented with dry mud from ponds inhabited by either the normal or pale race of this Branchiopod, but all in vain. Neither jars kept on ice in a large refrigerator, nor frozen dampened mud, gradually or suddenly thawed, developed any larvæ. The mycelium of a fungus, a few Daphniidæ and microscopic organisms were the only result."

Some time during April, 1888, the junior author collected a considerable number of females of *B. vernalis*, and selecting such as had their ovisacs filled with eggs, put them into a jar of water, in the bottom of which was placed earth taken from the garden. These females were allowed to remain here until they died, which was within about two weeks. The water was allowed to evaporate, the mud became dry and was moistened only once or twice during the summer. It was, of course, as dry as dust the greater portion of the time. On September 27, this dirt was broken up and put into another jar and covered with water. Immediately numbers of the eggs came to the surface and remained floating there about two days, when they went again to the bottom. On October 9, larvæ were, for the first time, observed swimming about in the jar and soon large numbers appeared. This experiment proves that the hatching of the larvæ of *B. vernalis* is by no means difficult to bring about, and that we may almost at will obtain them for observation. It also shows that it is not necessary that the eggs should ever be subjected to a freezing temperature.

That we have in our experiments succeeded in getting a view of the larvæ immediately after their exclusion from the eggs, we are not wholly certain. They could, at all events, have escaped but a short time before they were seen. One specimen was observed while in the act of escaping from the egg-shell; but the specimen seemed to be unable to extricate itself and may have been sticking there for some time and meanwhile undergoing change.

One thing, however, appears to be evident, namely, that the larva differs in some important respects from that of *B. stagnalis* as figured and described by Dr. C. Claus in his paper, "*Zur Kenntniss des Baues und Entwickelung von B. stagnalis und Apus cancriformis;*"

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[2] U. S. Geol. and Geog. Survey Wyoming and Idaho for 1878. Washington, 1883.

and it is highly probable that it leaves the egg in a more advanced stage of development.

According to Dr. Claus the nauplius of *B. stagnalis* on leaving the egg is of a dull yellow (*trubgelb*) color, which has, as its cause, a multitude of bright granules and globules, and this color is so decided that for some time the view of the internal anatomy is obscured. The larva of *B. vernalis*, on the contrary, is very pale, and will, therefore, more readily lend itself to investigations on the early condition of its internal organs.

In the case of *B. stagnalis* the post-cephalic portion of the body is at first globular, but later becomes more elongated and oval,and finally, when the limbs have begun to bud out, changes to a conical form. The same portion of the body of *B. vernalis* is from the first proportionately shorter and broader. Furthermore, there are, in the earliest stages seen by us, the lateral buds of three or four pairs of post-maxillary appendages. The most striking difference between the larvæ of the two species appears, however, to be found in time of appearance of the paired eyes. According to Claus those of *B. stagnalis* do not appear until the first and second pairs of thoracic segments have become four-lobed and ten or eleven segments have been marked out. The larva of *B. vernalis* appears to possess both the median and the paired eyes at the time of escape from the egg ; at least the paired eyes are plainly visible in the earliest observed stages, when there are but the merest swellings to indicate the positions of the first four thoracic limbs. Thus the true nauplius condition of *B. vernalis* appears to be passed through before the larva escapes from the egg ; it is excluded as a metanauplius.

It is interesting to note that the larva which we saw endeavoring to escape from the ruptured egg-shell was enveloped in a thin transparent membrane. Whether this was the inner egg-membrane or a blastodermic moult we do not undertake to say. Zaddach's observations on Apus will be recalled in this connection. (*De Apodis cancriformis, 1841*).

Our smallest larvæ measured in length ⅔ inches.

II. *Description of a supposed new species of Branchipus*, B. GELIDUS. Male conforming closely to the description of *B. bundyi*, Forbes[3], except that the caudal stylets are linear-lanceolate instead of broad and blunt. Frontal appendages long and narrow. Clas-

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[3] Illinois Museum Nat. Hist., Bulletin No. 1. p. 25.

pers grooved on inner side near the tip, and terminally tridentate rather than bifid, there being a third process which is situated on the anterior edge of the tip of the clasper ; this process rounded instead of pointed. Female characterized by a structure that could hardly have been overlooked had it been present in *B. bundyi.* This consists of two prominent processes of a conical form that grow out from the dorso-lateral surface of the tenth thoracic segment, one on each side, and project backward, across the eleventh segment and for a short distance on the segment that contains the genital organs. The posterior ends of these processes stand out free from the body. The ninth segment with a similar but much smaller process on each side, which overlaps the one on the tenth segment. Ovisac about as broad as long and with a prominent median process.

The function of these dorsal outgrowths is not known to us. It may be suggested that they furnish means for the male to retain firm hold of the female. The claspers of this species are far less powerful than are those of *B. vernalis* and may not be alone equal to the task imposed on them. Possibly the rounded tubercle found at the base of the second joint of the claspers is applied to the processes on the back of the female and hold retained by means of the minute suckers on the tubercles.

In order to ascertain the nature of the outgrowths found on the females, consecutive series of sections were cut from hardened and stained specimens. The organ in question is, of course, bounded outwardly by a chitinous wall ; but it is also, at most points, distinctly separated from the rest of the body by another wall of chitin. This is, however, incomplete, so that the cavity of the process is in communication with the cavity of the body. From the interior wall there radiate outward to the external wall a great number of bands or trabeculæ also apparently of chitin. These bands,as they pass outward, divide and anastomose so that the interior of the process is divided into communicating cells. Where the process frees itself from the body these bands soon cease to be seen. For some little distance behind the points where the processes leave the body there is found, along the middle of the back, the double-wall arrangement, with chitinous bands running from the inner wall to the outer. In the meshwork of chitinous bands, especially of the processes, there are found numerous small nucleated cells or corpuscles. The extremities of the processes are filled with these.

As to the habits of this species little is known. In the pond where large numbers occurred in the spring, no specimens of *B. vernalis* were seen. This fall when the same pond was visited not a specimen of the new species was to be found, while *B. vernalis* abounded.

It was observed that while the males were swimming about, the long and narrow frontal appendages were frequently rolled up and again extended. They present under the microscope a beautiful network of muscular fibres, in the meshes of which are numerous ganglionic cells.

A CORNER OF BRITTANY.

By J. WALTER FEWKES.

"BILLET pour Roscoff, s'il vous plait." The train is waiting a the Gare St. Lazare in Paris, and in a few moments we are hurried along beyond the fortifications, past Bellevue, Sevres and Versailles, through a wooded country, alternating with rich farms and beautiful fields. All day long we ride through Normandy and Brittany, looking out of the window of the coupé on one of the most interesting landscapes of France, crowded with towns and cities of historic interest and scenic beauty, every hour presenting some new phase of life to relieve the monotony of the trip. What is our destination and what leads us to turn from the beaten tracks of European travellers? We have abundant time to answer these questions before we reach the end of our journey.

Our destination is Roscoff, a town in the department of Finisterre, frequented by artists, better known to naturalists, and too rarely visited by travellers, who have penetrated into all the most picturesque corners of Europe. Roscoff, a fishing village, truly Breton in character, preserving many features of the old France, and presenting a pure example of ancient Brittany, unchanged by modern innovations. Roscoff has not a casino nor knows the swarms of pleasure seekers which many other towns on the coast of France draw to themselves every summer. It has no delightful promenades, no beautiful forests, but it has its wonderful rocks, its soft, laughing cli-